RADIOLOGICAL EVALUATION OF OBSTRUCTIVE JAUNDICE: COMPARISON OF USG, CT AND ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY

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CERTIFICATE

This is to certify that this dissertation entitled "RADIOLOGICAL EVALUATION OF OBSTRUCTIVE JANDICE: COMPARISION OF USG, CT AND ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY-" submitted by Dr.A.K.Senthil kumaaran, to the faculty of Medical Gastroenterology, The Tamilnadu Dr.MGR Medical University, Guindy, Chennai-600032, in partial fulfillment of the requirement for the award of DM., Degree Branch IV (Gastroenterology) is a bonafide work carried out by him under my direct supervision and guidance.

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Dt: 26.11.2009

CHAIRPERSON
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Sub. Ethical Committee project work - approved.
Ref: Lr.No.3944/P&D/09 Dt. 17.11.09.

With above reference, the Institutional Ethical Committee meeting for the following students was conducted at our institution on 26.11.09

1.	Dr.M.Manimaran	Study on clinical features, success rate and complications of endotherapy in [illegible] diseases
2.	Dr.P.I.Rajanbabu	Spectrum of clinical manifestations of Carcinoma Stomach.
3.	Dr.A.K Senthilkumaaran	Comparing the role of immune modulators with ERCP in Obstructive Jaundice
4.	Dr.M.Shameem Ahmed	Study on Palliation of malignant biliary obstruction with plastic stents.

We are glad to inform you that at the Ethical Committee meeting the documents were discussed and the above short term projects are Ethically approved.

CHAIRPERSON 26/11/09
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To
The Individuals

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ABSTRACT

AIM: To compare the accuracy of ultrasound and CT scan in evaluation of level and cause of biliary obstruction with Endoscopic retrograde cholangiography.

MATERIALS AND METHODS: Ninety patients with suspected biliary obstruction underwent Ultrasound followed by CT scan of the upper abdomen and Direct Cholangiogram (ERC) in the Department of Radiology Kilpauk Medical College & Hospital and Department of Digestive Health & Diseases, Kilpauk Medical College.

The level of biliary obstruction was grouped as hilar, suprapancreatic and intrapancreatic. Similarly the cause was grouped as malignant or benign. Confirmed diagnosis was obtained by USG-guided FNAC or ERC-biopsy or preoperatively by other imaging modality.

RESULTS: 34 male and 56 female patients in the age of 26 to 86 years were examined. Accuracy of USG in identifying the correct level of obstruction was 89%, 91% and 87% for hilar, suprapancreatic and intrapancreatic respectively. Similarly CT accuracy was 82% for the hilar, 87% for the suprapancreatic and 80% for the intrapancreatic level.

66 patients had malignant and remaining 24 had benign obstruction. The most common cause of malignancy was cholangiocarcinoma (26.6%) followed by ampullary (24.5%), gallbladder carcinoma (13.3%) and carcinoma of pancreatic head (8.8%).

The most common benign obstruction was choledocholithiasis (17.7%) followed by postoperative stricture 4 (4%) and choledochal cyst (4.4%). Accuracy of identifying malignancy was 91%, 89% and 87% for the USG, CT and ERC respectively. Similarly USG, CT and DC had accuracy of 84%,84% and 87% for identification of benign cause. These findings were statistically significant (p value=< 0.05 at 95% confidence interval).

CONCLUSION: This study showed almost similar accuracy of USG, CT and ERC in identification of level and cause of the biliary obstruction. However considering cost, availability and patient friendly nature, Ultrasound should be the first imaging modality of choice in evaluation of patients with obstructive jaundice. If it is combined with other imaging modality like CT or DC (ERC) the sensitivity and accuracy increases further. Because of the hazards of the invasive procedures like PTC and ERC, their use should be reserved for those who require therapeutic interventions.

ABBREVIATIONS

B.T.	Bleeding time
CBD	Common Bile Duct
CHD	Common Hepatic Duct
CT	Computerized Tomography
DC	Direct Cholangiography
ERC	Endoscopic Retrograde Cholangiography
ERCP	Endoscopic Retrograde Cholangiopancreaticography
FNAC	Fine Needle Aspiration Cytology
Hb	Hemoglobin
HbsAG	Hepatitis B Surface Antigen
PT	Prothombin Time
PTC	Percutaneous Transhepatic Cholangiography
PTCD	Percutaneous Transhepatic Cholangiography and Drainage
SGOT (AST)	Aspartate transaminase
SGPT (ALT)	Alanine transaminase
USG	Ultrasonography

INTRODUCTION

Jaundice (icterus) refers to yellow pigmentation of skin,sclera and mucosa due to raised plasma bilirubin (e.g.>35micromol/L) [1].Jaundice may be obstructive (surgical) or nonobstructive (medical). The basic distinction can usually be made on the basis of the history, physical examination and liver function tests (LFTS).[2]

Obstructive jaundice may be complete or intermittent. Alternatively there can be chronic incomplete obstruction leading to pathological changes in the ducts or liver. Dilatation of the whole biliary tree may be present or if the obstruction is high, it may affect only the intrahepatic biliary ducts (IHBDS). There may be no biliary dilatation if; [3]

1] The obstruction has only been present for a short time.

2] There is secondary biliary cirrhosis due to long standing obstruction complicated by Inflammation and infection.

3] Lack of dilatation is a specific feature of a certain diseases; e.g. primary sclerosing cholangitis (psc).

The incidence of obstructive jaundice is increasing rapidly in the past 10 years, which may be due to media publicity, and availability of various diagnostic modalities.[4] the common causes of obstruction are neoplastic, followed by stones/strictures. [5,6]

Among the non-neplastic causes biliary obstruction is found in 2-10% of calculus disease, 8% caroli's disease and 90% of sclerosing cholangitis.[6]

It is present in 1% of cases with ulcerative colitis and congenital anomalies of biliary system.[7]

In carcinoma of gallbladder, the incidence of cholelithiasis is 70-90%. Porcelain or calcified gallbladder can be a precursor of GB carcinoma. The gallbladder carcinoma is an aggressive disease with overall survival rate of 5%.[4, 8,9,10]

USG and CT are important imaging modalities for the evaluation of the Same [11,12,13,14].

The presenting symptoms in all patients with obstructive jaundice are jaundice and pain abdomen and the presence of deep jaundice warrants thorough investigations.

Investigation of suspected obstructive jaundice should ideally begin with an USG examination preceded by LFTs. Isolated elevation of serum alkaline phosphatase indicates biliary obstruction and needs further investigations that is USG.[4,15]

In the past, imaging evaluation of biliary system was performed by indirect methods such as upper GI-Endoscopy, Hypotonic Duodenography and intravenous Cholangiography.These methods are now obsolete and replaced by more sensitive modalities like USG, CT and MRCP.[16,17]

Ultrasonography is the primary modality of investigation with accuracy of 80%or more for billary diseases.

USG is used not only as a diagnostic tool but also for therapeutic potentials. Due to it's wide availability in most hospitals and treatment centers it has proved its benefit in jaundiced patients.

Very few studies have been done to evaluate the cause and level of obstruction of biliary tree in our country. Therefore this study is thought to be helpful in testing the accuracy and sensitivity of different modalities including USG and CT in evaluation of the cause and level of biliary obstruction compared to Direct Cholangiogram (ERCP).

The accuracy of USG in diagnosing dilated biliary tree is 97%, which are grouped into three grades.[20]

Grade I-------Central dilatation of IHBD, right or left main hepatic ducts and ductules of more than 3mm

Grade II------Moderate or intermediate dilatation (between grade I and III).

Grade III---- Marked dilatation of IHBDs up to the peripheral third of the liver parenchyma.

In the evaluation of extra-hepatic biliary ducts dilatation is designated if CBD more than 8mm in non-cholecystectomised and more than 10mm in post-cholecystectomised patient. Distal CBD visualization is difficult with USG and requires ERCP.

CBD stricture is also grouped into three types by USG.[18]

Type I---- Smooth tapering stenosis with proximal CBD dilatation.

Type II---- Abrupt cut off of CBD

Type III---- Presence of echogenic nodules without acoustic shadows suggest which should be confirmed by ERCP

Gallbladder neoplasm is shown as irregularly outlined echogenic mass or focal thickening of gall bladder with or without obstruction in the CBD and dilatation of IHBDs. Echogenicity is slightly more in case of cholangiocarcinoma as compared to GB fossa mass. Other advantages of USG are to detect choledocholithiasis, choledochal cyst as well as secondaries in the liver. Visualization of hilar lymphadenopathy with extrinsic compression of biliary tree is also possible with ultrasonography.

Detection of smaller lesion like calculi, strictures, tumors can be added by utilisitation of peroperative ultrasonography and may be an additional technique in future. Endoscopic USG has also proved useful in more detailed assessment of disease of biliary system and staging of malignancy.[19]

Regarding the level of obstruction, the accuracy of USG is also high and can reach up to 95 %(Gibson et al). Obstruction of biliary tree has been divided into three level; [4,20]

Level I ---- Intrahepatic (at porta and above the porta), also include hilar and localized intrahepatic lesion

Level II ------Suprapancreatic (between porta hepatis and pancreatic level)

Level III -----Intrapancreatic or distal (ampullary and pancreatic lesions).

The causes of biliary obstruction are grouped as follows;[4,20]

1. Malignant causes (primary or metastases)

2. Benign e.g. Sludge, stones, postoperative strictures, cysts, mirizzi's syndrome, pancreatitis etc
3. Indeterminate (when cause is not identified)

Direct cholangiogram namely PTC and ERCP are regarded as gold standard method of imaging the biliary tract. With the development of fiber optic endoscopes the use of ERCP has widened, it has advantage of visualization of both biliary and pancreatic ducts along with chance of assessment of stomach and most of the duodenum. It can be utilized to take biopsy or cytology from ampulla. ERCP is useful in diagnosis of choledocholithiasis and pancreatic neoplasms. Calculi impart radiolucent filling defects however stricture may be seen as smooth or irregular narrowing of CBD depending upon its etiology. Irregular mass/compression of ducts are seen in case of malignancy. ERCP is beneficial in non-dilated biliary tree and also in periductal fibrosis (sclerosing cholangitis). It is the most appropriate imaging modality for the investigation of post cholecystectomy syndrome.[33,34,35]

The application of CT Scan is increasing in the evaluation of biliary system. Reconstruction of data in coronal, sagittal and axial sections may provide more diagnostic information. It is more beneficial in those cases where USG is difficult, such as obese patients, and presence of excessive bowel gas. Gallstones are seen as hyperdense filling defects in the GB. Pure cholesterol stones are hypodense. Cysts are seen as well defined low attenuating masses. Malignant lesions are seen as irregular enhancing masses with or without central necrosis.

Among the causes of obstruction 80% are malignant and 20% are non malignant. This include choledocholithiasis, iatrogenic stricture, traumatic stricture, choledochal cyst, mirizzi's syndrome and pancreatitis, aortic aneurysm, parasitic diseases and idiopathic.

Commonest level of obstruction is intrapancreatic followed by hilar and supra pancreatic level.[22]

Palliative management of inoperable or nonresectable pathology is external/internal biliary drainage. In hilar obstruction PTCD is useful however in mid or low CBD obstruction either internal stenting or endoscopic prosthesis is useful

Tissue diagnosis of biliary obstruction can be provided by US guided FNAC or biopsy

AIMS AND OBJECTIVES

AIM:

To compare the role of USG and CT with direct cholangiography (ERCP) as gold standard in predicting the level of biliary obstruction and to find cause of biliary obstruction in patients with obstructive jaundice.

OBJECTIVES:

1. To find the sensitivity, specificity, positive predictive and negative predictive values of CT and USG for detection of level of biliary obstruction.

2. To find the sensitivity, specificity, positive predictive and negative predictive values of CT and USG in the evaluation of the cause of biliary obstruction.

REVIEW OF LITERATURE

ANATOMY OF BILIARY TREE

The liver is composed of many hundred of units called lobules, and each lobule is composed of radial columns of parenchymal cells. Between these columns of cells lie the bile capillaries, the walls of which are the liver cells themselves. The bile capillaries empty in to interlobular bile ducts, which enter in their turn into larger bile ducts, until finally two chief branches are obtained; a large branch from right and a small branch from the left lobe of liner, called right and left hepatic ducts respectively. These ultimately unite to form the common hepatic duct.

The common hepatic duct passes downward and just beyond the porta hepatis, it is joined by the cystic duct from the gall bladder (a pear shaped enlargement lying distal to the cystic duct) to form the common bile duct. The common hepatic duct is about 25 to 30 mm in length and about 4mm in diameter. The cystic duct is about half the diameter of the hepatic duct but somewhat longer-about 30 to 37 mm in length. It courses backward and medially to join the common hepatic duct.

The common bile duct is about 7.5 cm in length and about the same diameter as the hepatic duct it passes downward between the two layers of the hepatoduodenal ligament, with the portal vein behind and the hepatic artery to its left. It then passes behind the second part of duodenum and runs in a groove between the duodenum and head of pancreas. Joining the pancreatic duct (still maintaining the separate lumen), it pierces the descending part of the duodenum

in its midportion to open obliquely into the lumen at the duodenal papilla.

The gall bladder is arbitrarily divided into four parts: the distal end or fundus usually reaches the anterior border of liver, the body run backward upward and to the left; the infundibulum is situated between the body and the neck

and consists of that portion tapering towards the neck; the neck is curved medially towards the portahepatis and contains spiral crescentic folds around the interior of its lumen, forming the spiral valve of Heister. The neck of gallbladder usually curves sharply like the letter "S". The gall bladder usually rests on the transverse colon in front and its neck is usually in close proximity with the duodenum.

PATHOLOGY OF JAUNDICE[27]

Jaundice (icterus) is the yellow discoloration of skin and sclera that occurs when bilirubin is elevated in the blood (a normal valve is less then 1.2 mg/dl) and in deposited in tissues. Jaundice becomes evidence when bilirubin level rises above 2.0 to 2.5 mg/dl.

Jaundice occurs when the equilibrium between bilirubin production and clearance is disturbed by one or more of the following mechanisms.

1) Excessive production of bilirubin

2) Reduced liver cell uptake;

3) Impaired conjugation;

4) Decreased intra hepatic excretion of bilirubin and;

5) Impaired extra hepatic biliary excretion.

First three mechanisms produce unconjugated hyperbilirubinema; the last two conjugated hyperbilirubinema (cholestatic jaundice)

Extrahepatic cholestasis results from obstruction of the extra hepatic bile ducts. Frequent causes include gallstones impacted in the common or right or left mainhepatic ducts and carcinoma of extra hepatic bile ducts, ampulla of vater, or head of pancrease. Less common causes of extra hepatic obstruction include,

- Cholangitis
- Congenital Artesia of extrahepatic ducts and
- Tumors or inflammatory lessons (e.g. in lymph node) causing extrinsic pressure on the bile ducts at any site.

REVIEW OF LITERATURE

Although USG is the primary modality having higher sensitivity, invention of CT and MRI have lead to demonstration of the cause and level of obstruction more accurately [28]

Robert N. Gibson et al [29] Conducted a prospective study of 65 patients with bile duct obstruction to evaluate the level, cause and tumor resectability radiologically. Patients with known or suspected bile duct obstruction were evaluated. Patients with post cholecystectomy bile duct stricture were excluded from the study. All 65 patients underwent ultrasound among them Computer tomography was performed in 51 patients.

Direct cholangiography was performed in 57 patients, PTC in 52 and ERC in 7, both in 2 patients). For the level of obstruction, patients were divided into two groups; a HILAR group, which included patients whose obstruction involved

the confluence of the right and left hepatic ducts or the proximal 2 cm of common hepatic duct and a non-HILAR group, which included those with lesions more than 2 cm from the confluence. These were compared to cholangography or surgery.

The causes on USG and CT were identified as: (a) tumor, as evidenced by a mass at the site of obstruction (b) Benign as evidenced by absence of tumor and presence of specific benign cause e.g. CBD calculi or choledochal cyst; and (c) indeterminate if neither of the above criteria was satisfied. The final diagnosis was established on either surgery or biopsy or cytology. For the assessment of the level of obstruction these was no significant difference between CT and US in identifying the level. US was correct in 62 of 65 patients (95%), incorrect in one (2%), and indeterminate in two (3%), CT was correct in 46 of 51 patients (90%) incorrect in one (2%), and indeterminate in four (8%). The accuracy of USG and DC for THE assessment of cause of obstruction was significantly more than CT ($P<0.01$).

In this study US was as accurate as CT in identifying the level of obstruction (95% Vs 90%) and USG was significantly more accurate in identifying the cause of obstruction (88% vs. 63%).

US correctly identified the cause of obstruction as often as DC (88% and 89%, respectively). They believed therefore that PTC or ERC might be avoided in many patients in whom cholangiogram is not required for assessment of tumor resectability, as they have major complications rates of 2% - 4%.[30,31] the reported sensitivity of US in choledocholithiasis in larger series ranges from

12% to 75%.[32]

Richard L. Baron et al 36 Conducted a retrospective CT study in 69 consecutive patients with proven biliary obstruction due to both malignant and benign causes to define and differentiate CT changes. They reviewed the following;

INTRAHEPATIC DUCTS: 69% of patients with malignant neoplasms had biliary dilatation compared to 28% with benign lesions. While nearly one third of patients with benign lesions (all with choledocholithiasis) had no intrahepatic duct dilatation, all those with malignant lesions had abnormally dilated intrahepatic ducts.

EXTRAHEPATIC BILIARY DUCTS: The degree of extra hepatic duct dilatation did not differ in benign or malignant lesions however abrupt termination of extra-hepatic biliary duct was characteristic of a malignant process in the absence of mass. Gradual tapering of a dilated duct was specific for benign diseases.

DETECTION OF CBD STONES:

CT showed CBD calculi in 10 out of 12 patients proven to have CBD calculi (size ranged from 0.5 to 1.8 cm).

GALL BLADDER:

In patients with distal obstruction only malignant lesions caused gall bladder dilatation.

All of 69 patients with proven biliary obstruction revealed CT Findings indicative of obstruction in all cases.

In six patients with choledocholithiasis, CT revealed only extra-hepatic dilatation; the sensitivity of CT in detection of CBD calculus was more than 80%. Hence extra-hepatic biliary dilatation may be the only CT indication of biliary obstruction.[37,38]

All patients with visible intrahepatic biliary ducts without concomitant extrahepatic dilatation had obstruction either at or proximal to the confluence of the right and left hepatic ducts. Contrary to the findings of Pedrosa et al [39,40] they did not find gross intrahepatic ductal dilatation to be specific for malignant disease. Similarly, the degree of extrahepatic ductal dilatation did not reliably distinguish benign from malignant lesions.

An abruptly terminated duct in conjunction with a mass due to malignant disease was visualized in all. In contrast gradual tapering of the terminal ducts was specific for benign disease whether or not a mass was identified on CT. **Faye C Laing and R. Brooke Jeffrey Pjr. et al** [6,7] Revised biliary dilatation to define the level and cause by USG in 110 patients. Level of obstruction was defined as pancreatic, suprapancreatic, and portahepatis. Likewise causes were pancreatitis, choledocholithiasis, neoplasm and stricture. All patients were examined in semi erect right posterior oblique position for distal duct and longitudinal scan for proximal duct.

Level of obstruction was identified by US in 91.8% cases and suggested the correct causes in 70.9%. The causes were CBD stone (37.2%), pancreatitis (27.1%) neoplasm (19%), stricture (6.3%) and indeterminate in 5.5%. Primary or metastatic neoplasm was correctly diagnosed by USG scan in 90.5% and

most of neoplasms obstructed the distal common duct hence they concluded that USG remains the initial screening modality for the evaluation of bile ducts inspite of the introduction of CT and MRI and provides differentiation between medical and surgical jaundice in more than 90% cases and also helps to guide patient management with regard to performing surgery, ERCP or PTCD [6,7,28]

Ricardo Robledo et al [41] conducted a retrospective USG study of eight patients with obstructive jaundice due to malignancy for the evaluation of cause of obstruction. All of them had ampullary carcinoma. Adenocarcinoma was found in all eight patients. All the patients exhibited intrahepatic and extra hepatic bile duct dilatation extending down to the distal common bile duct. In 6 cases the mass causing the biliary obstruction was demonstrated and varied in size from 1.6 to 2 cm. In four of these cases, the growth took the form of a polypoid, intraluminal mass in the distal CBD. In the remaining two cases, it gave rise to abrupt termination of the duct. Accuracy of USG in the diagnosis of tumor was 75%.

Six patients had a distended gall bladder, and five had echogenic bile in USG the pancreatic duct dilatation varied from 3 to 10 mm (mean, 5.2 mm).[42] Percutaneous transhepatic cholangiography was performed in six patients and demonstrated tumor in all.

Joan P. Campbell et al 43 did ultrasonographic analysis in evaluation of pancreatic neoplasms in 51 patients. Sonograms were interpreted without knowledge of results from other procedures. 50 of 51 pancreatic masses were identified at the time of initial evaluation by US. Thirty-two masses were in

the pancreatic head, periampullary region or neck; ten in the tail, and three in the body.

Six patients had diffuse or multifocal disease. All masses were solid and relatively hypoechoicic, with the exception of mucinous cystic neoplasms, which had cystic components.

Twenty-seven patients had pancreatic duct dilatation at US. Lymphadenopathy was identified at US in 16 patients and liver metastases were seen on sonograms in 16 patients. In three more patients liver metastases not seen in US were discovered at surgery.

Twenty- nine patients had obstructive jaundice and USG showed.biliary tract dilatation in all of them. Surgery, CT, ERCP, PTC and autopsy confirmed their findings. Regarding resectability, they arbitrarily considered patients with no evidence of liver metastases, lymphadenopathy, or vascular involvement as sonographically resectable disease. Thirty-one of the 50 identified tumors were judged to be unresectable at US because of liver metastases (16 patients), lymphadenopathy (16 patients), or vascular involvement (12 patients). Many patients had more than one contraindication for resection. They concluded; " US as the most readily available and least expensive of the imaging modalities used in assessment of the upper abdomen and very useful in detection of pancreatic tumors as well as evaluation of disease

Ricardo Robledo et al 44. Analyzed the US characteristics and accuracy in demonstration of extrahepatic biliary tumors. Fourtynine patients with histopathologically proven cholangiocarcinoma were evaluated. Findings were

compared with PTC (n=47) and ERCP (n=2). Bile duct carcinoma was relatively rare and represented only 0.01%to 0.04% of all malignancies. Ultrasonography was the most common examination performed which demonstrated the tumor in 96% including the focal or diffuse thickening of bile duct wall in 6.4%patients.

Three levels (Hilar, supra pancreatic and distal) of extrahepatic biliary tree obstruction were defined and showed high frequency of tumors at hilar level. It was probably due to clear acoustic window of gall bladder and liver that facilitated tumor detection at hilum.

Sally E. Mitchell, Robert A. Clark [45] made a comparison of sonography and computed topography (CT) for the diagnosis of choledocholithiasis. In their study group of 54 patients, 49 had common bile duct stones. All 54 patients underwent sonography; the diagnosis of choledocholithiasis was made in 14 of 54 patients. Sonography correctly diagnosed nine of 49 patients with choledocholithiasis with sensitivity rate of 18 % and with accuracy rate of 19% (10 /54). Gallbladder stones were associated with choledocholithiases in 21 of 49 patients. Among them15 patients had undergone previous chlecystectomy. CT was done in 32 patients with 30 of them having choledoclolithasis. CT correctly identified common duct calculi in 26 of 30 patients with sensitivity rate of 87%. Accuracy rate for CT was 84 % (27/32). Their results confirmed those of others [46,47,48,49] that sonography has limited ability in depicting stones in the common bile duct.

CT has been shown to be effective for evaluation of common duct stones [39,40,50,51]. In the study of Pedrosa et al [39] CT correctly identified 14(82%) of 17 common duct calculi, with four false positive studies.

Baron et al [50] identified 10(83%) of 12 common duct stones; Jeffrey et al [51] correctly identified stones 19(90%) of 21 patients. They found CT especially useful for evaluation of the distal bile duct and ampulla, areas poorly imaged by sonography. Their results in aggregation suggested that;

>CT is very reliable for the diagnosis of choledocholithiasis.

>Sonography remains an excellent initial procedure for detection of duct dilatation. CT is also useful for definition of the level and cause of obstruction.

> Direct cholangiography may then be reserved for those cases in which,

a. Further confirmation is required preoperatively.
b. a cause cannot be determined by sonography or CT,
c. ducts are not dilated on sonography or CT but there is a strong clinical suspicion of biliary obstruction.
d. Percutaneous catheter biliary decompression is indicated or.
e. endoscopic retrograde sphincterotomy is the treatment of choice for choledocholithiasis.

In a study conducted by **Arnold C. Friedman 52** among the patients with choledocholithiasis and biliary neoplasm, it was shown that US has the pivotal role in evaluating the jaundice patients by differentiating obstructive from non-obstructive jaundice. When was positive for obstruction, at least one additional tests such, as PTC, ERCP or CT was required for confirmation.

Among them PTC was still considered to be the correct diagnostic technique. The detection rate in the past was relatively low (level of obstruction in 60% and causes in 38%). Now the overall accuracy is improved (level 88% and cause 70% by USG alone).

C. Rumack et al 53 showed that group - I or intrapancreatic level of obstruction is the commonest site of obstruction and it was caused most commonly by pancreatic mass followed by CBD stone and stricture. PTC was complementary in the diagnosis of stricture found in USG. Group - II or supra pancreatic level was the second and again malignancy was the commonest cause, followed by inflammatory strictures and stone.

Group III or hilar obstruction - again malignancy was the most common cause 95% of cases were accurately identified by USG alone which was supported by dilated IHBD and normal CBD with echogenic mass at porta.

Pedrosa et al [39,40] retrospectively analyzed the role of computerized tomography (CT) in evaluation of level and cause of obstruction in the biliary free. CT scans of 67 patients were analyzed to evaluate each. The overall accuracy of CT in determining the exact level was 97% the most reliable indicator was the number of rings (produced by dilated bile ducts) which had excellent correlation with the results of direct cholangiography.

Regarding the cause of biliary obstruction CT correctly identified cause in 94% of the cases and was considered important in obstructive jaundice and eliminated the need for invasive procedures in many cases.

Threasa H. Reiman et al [54] evaluated 92 patients with biliary obstruction proximal to the pancreatic segment with computed tomography (CT). Observations of the level of obstruction were compared with percutaneous transhepatic cholangiograms. They studied the ability of CT to enable one to determine the precise site of obstruction and to depict the total extent of the pathology; they also evaluated the findings, which were predictive of benign or malignant diseases. The CT parameters assessed included;

- Severity and distribution of ductal dilatation.
- Presence or absence of obstructing mass.
- Presence or absence of portal lymph nodes.
- Lobar or segmental atrophy.
- Alteration of attenuation of portal fat, and the degree of abruptness of ductal termination.

CT enabled correct prediction of 26 (93%) of 28 patients level- I obstruction. CT correctly predicted obstruction at level-II (confluence of RT and LT Hepatic ducts) in 14 out of 16 patients and all patients with level – III (suprapancreatic) obstruction.

Overall, CT correctly identified level of obstruction as defined by PTC in 92 % cases.

Regarding the extent of disease and its distribution in the porta hepatis by CT Scanning, it was correct in 26 of the 27 patients with malignant obstruction. A soft tissue mass (size 1.5 to 8 cm) was present at the expected site of the duct in 24 of 27 cases, the duct caliber changed from maximal dilatation to normal or

less than normal dilation over a distance of less than 5 mm. They applied CT criteria to each of 44 proven cases making a diagnosis of malignant disease when a mass larger than 1.5 cm was present in the location of the duct and/or lesser omental lymph nodes larger than 2 cm were seen. This resulted in correct diagnosis in 25 of 27 proven cases of malignancy.

Takashi Kokubo et al [55] analyzed the effectiveness of sonography in finding out the cause and level of obstruction in comparison to CT.Radiological findings were evaluated in six patients with mucin hyper secreting intrahepatic neoplasms which was confirmed at surgery. Marked biliary dilatation distal to the tumor with filling defects was noted in dilated ducts (PTC sensitivity 100%, US and CT sensitivity 84%). Tumor showed multilocular cystic mass in the liver on CT/US and filling defects on PTC.

M. Kristin Thorsen et al 56 retrospectively studied 53 patients with documented primary biliary carcinoma with computed tomography. 26 patients of carcinoma of gallbladder and 27 patients with carcinoma of biliary duct were evaluated. All underwent CT examination of abdomen and had histological conformation by percutaneous biopsy, laparoscopy, surgery and /or autopsy. Twenty of the twenty-one patients preoperatively had a gallbladder wall thickness of more than 5 mm. Twenty patients had marked contrast enhancement of gallbladder wall. An intraluminal mass was detected in nineteen patients. CT in 52% of cases studied identified gallstones. Direct invasion of the liver by the tumor was the most common finding in metastatic disease, occurring in 22 patients (85 %).

Seventeen patients had lymphadenopathy in the pericholedochal, peripancreatic or periaortic group. 50% of patients had dilated bile ducts either secondary to tumor invasion or compression by abnormal lymph node. Ascites was seen in four patients with Ca GB. Likewise peripheral liver metastasis and invasion of gastrointestinal tract were seen in three and two patients respectively.

Twenty-seven patients had carcinoma of the bile duct. All were adenocarcinomas except one leiomyosarcoma arising in choledochal cyst and another had combined hepatocellular and cholangiocarcinoma. CT of eight patients was found to have peripheral intrahepatic mass (30%). Seven patients (26%) had tumor involving the junction of right and left hepatic ducts. All patients had dilated intra hepatic ducts. The most common location of tumor involvement in the extrahepatic biliary ductal system was the distal CBD, which was seen in eight patients (30%), Five of these patients had no associated mass and only finding was intra and extra hepatic biliary duct dilatation. Two patients with distal bile duct tumor had pancreatic head invasion mimicking cancer in the head of pancreas .Of the total number of patients with biliary duct malignancy, ten patients had lymphadenopathy either in porta, pericholedochal, peripacreatic, or periaortic regions. Four patients had ascites also.

John T. Engels et al [57] conducted a CT fifty-six patients with pathologically proven biliary cancer and seventy-five patients with no evidence of biliary disease in an attempt to define the normal anatomy of the lymphatic system draining the bile ducts and the prevalence of extrahepatic spread of primary biliary cancer into retro peritoneal planes.

GALL BLADDER CANCER-- Twenty patients with gall bladder carcinoma were examined and liver metastasis were correctly identified in five of six patients. Peritoneal carcinomatosis was identified in seven of nine patients. In five patients there was diffuse invasion of hepatoduodenal ligament and confluent areas of soft tissue attenuation extended along the posterior aspect of the pancrease.

Discrete nodes were identified in thirteen patients (65%), the foramen of Winslow was involved in five, the superior pancreaticodudenal node was involved in four and multiple posterior pancreatodudenal nodes were identified in six. Celiac adenopathy was present in six and was only abnormality in five.

HILAR CHOLANGIOCARCINOMA-- twenty-two patients with hilar cholangiocarcinoma underwent CT examination. Liver metastases were identified in three patients; CT was false positive in one patient and failed to demonstrate the metastasis in other patient. Peritoneal spread was correctly identified in one patient but was missed in another. Direct invasion of hepato duodenal ligament was seen in four patients; however another one with unexpected gross infiltration of the hepatodudenal ligament was missed in CT scan. Seventeen patients had one or more nodal involvement with metastatic tumor, foramen of Winslow was involved in eight and superior pacreaticodudenal in seven. In three patients both group of nodes were enlarged. Posterior pancreaticodudenal nodes were present in twelve patients. Celiac adenopathy was seen in eight patients. CT detected all metastatic lymph nodes, which were later identified at laparatomy.

The lymph node range from 1.5-4cm in maximum diameter.

DISTAL CHOLANGIOCARCINOMA-Twelve patients with distal duct carcinoma were evaluated by CT scans. Six had no evidence of extrabiliay disease. Three had liver metastasis. CT correctly demonstrated the peritoneal carcinomatosis in one patient but failed to do so in another. Adenopathy was present in four patients three of whom had liver metastasis. There were nodes at foramen of Winslow in four patients, in the posterior pancreaticodudenal group in three and superior pancreaticodudenal in one. The size of nodes ranged from 1.5-2.5cm in two patients and exceeded 2.5cm in other two.

DIFFUSE CHOLANGIOCARCINOMA- Two patients examined with CT had carcinoma diffusely involving the extra hepatic duct. Neither patient had any evidence of extra biliary spread of disease at the time of presentation.

Shelley Nan Weiner et al [58] reviewed the computed tomographic and sonographic findings in twenty-six patients with gall bladder carcinoma. Primary carcinoma of the gallbladder is the fifth most common malignancy of the gastrointestinal tract.[59], yet the diagnosis often difficult to make preoperatively.[60]

The most common presentation of gallbladder carcinoma in their series was a large mass replacing or surrounding the gallbladder, which was seen in eleven patients (42%). Nine had evidence of calcification that were thought to be the gallstone trapped in the tumor or calcification of gallbladder wall. In six patients (23%) a fungating mass was seen protruding into the gall bladder lumen. Neither acoustic shadow nor changes in position of these masses were

seen. Five of these patients also had gallstones. Another four (15% presented with irregularity and /or asymmetric thickening of the gall bladder wall.

Two patients showed a soft tissue tumor in the extrahepatic bile duct. In retrospect sonography and CT were found to be complimentary especially when there was abdominal gas or anterior reverberations in the gall bladder that prevented a complete sonographic evaluation.

The diagnosis of gall bladder carcinoma was missed initially in ten patients out of them in three diagnosis of cancer of pancrease was made even in retrospect because of combination of obstructive jaundice, dilated extra hepatic bile ducts and a mass in a region of a head of pancrease in sonography. It was later confirmed that mass was secondary to metastatic disease within nodes around the distal common bile ducts. The author hence concluded that the major sonographic findings in gallbladder carcinoma described in literature can also be applied to CT. [61,62,63,64,12] A large mass replacing the gall bladder, the most common presentation of gall bladder carcinoma in these series was also the most frequent finding in the reports of Yeh ([61]), Raghavendra [12] and Dalla Palma et al [62].

R P Gold et al [47]conducted a prospective study of twenty-five patients with obstructive jaundice with CT, USG and percutaneous trashepatic cholangiography (THC). Nineteen had obstruction of the biliary tree. Differentiation of obstructive from non-obstructive cause was 72% accurate with USG, 92% with CT and 96% with THC. Although the precise location of the obstructive lesion was determined in 12/19 cases by CT and 9/19 by USG,

the cause was identified in only five by CT and 7 by USG. THC was 100% successful in establishing both cause and site of obstruction without significant complications.

Khurram M et al [65] had a retrospective study of two hundred and twenty six patients who underwent ERCP for evaluation of obstructive jaundice.

Growth / masses and stones were commonest causes of obstructive jaundice. Choledocholithiasis was common in males, while biliary channel related growth/masses were common in females (p-values=0.03). ERCP related complications were noted in eleven (4.8%) patients.

MATERIALS AND METHODS

STUDY DESIGN:

It was a prospective non-randomized study carried out from January2008 to January 2010.

PLACE OF STUDY

The study was carried out at Department of Digestive Health & Diseases and Department of Radiology.Kilpauk Medical College, Chennai.

SELECTION OF PATIENTS:

Patients with obstructive jaundice were selected from out patients in the department of digestive health & diseases Kilpauk medical college. Brief clinical history was taken as per proforma attached herewith.All the patients with dilated intrahepatic biliary radicles were included in the study.

EXCLUSION CRITERIA

1.Patients without dilated billiary ducts.

2.Patients unfit for invasive procedures like ERC.

3. Patients unwilling to undergo the required investigation.

STUDY METHOD:

All patients with strong suspicion of obstructive jaundice were evaluated clinically and with biochemical tests before sending them to radiology. Detailed information was recorded in a predesigned data collection sheet (appendix I). Information included was particulars of the patients, clinical features, and biochemical tests. Patients with Obstructive Jaundice were sent to

the radiology department for detailed imaging evaluation including USG, CT.The USG evaluation was followed by CT scan of the upper abdomen and DC (ERC)

USG:

Transabdominal sonography was carried out with commercially available real time scanner (GAIAMT 8800 medison with color Doppler facilities) at transducer frequency of 3.5, 5 MHZ curvilinear probe using neutral matching gel over the parts.

Patients were instructed to have at least 4 hours fast past prior to USG.

Scanning in transverse, oblique and sagittal planes were carried out.The degree of billiary dilatation, level of obstruction as well as probable cause of obstruction was evaluated. Likewise any space occupying lesion in the liver, lymphadenopathy, portal vein thrombosis, cholelithiasis were also looked for.

CT SCAN:

In all 90 cases CT scan of abdomen was carried out after the USG evaluation. Pre and Post IV contrast images along with oral contrast were taken in the axial planes Hitachi spiral CT scan machine (Japan) was used for the CT Scan.

Evaluation of level and cause of obstruction was carried out as in ultrasound. Evaluation of any liver metastasis and lymphadenopathy, ascites were also part of CT assessment

DIRECT CHOLANGIOGRAPHY (ERC):

ERC was carried out in Department of Digestive Health & Diseases ,Kilpauk Medical College by Well Trained Endoscopist.

ERCP was carried out by endoscopist, using a side viewing duodenoscope (Pentax A01447 Opticle Lens Ltd Japan.). The likely level and cause of obstruction were mentioned.

The level of obstruction was defined according to NICHOLS 18

Classification depending on anatomic location;

LEVEL I: Intrahepatic or hilar level (at or above the porta hepatis)

LEVEL II: Suprapacreatic level (lower limit of the hilar level and upper border of head of pancreas)

LEVEL III: Intrapancreatic or distal level (includes pancreatic and ampullary region of CBD, ampullary and pancreatic obstruction).

If the proper level of obstruction couldn't be determined it was considered as indeterminate The causes were also divided in to malignant and benign. Presence of mass or abrupt termination of bile ducts with absence of distinct benign cause was interpreted as probable malignant cause. Similarly absence of mass or presence of specific benign cause such as CBD calculi or choledhochal cyst was considered benign.The ultrasonographic and CT findings were compared to that of DC regarding the level of billiary obstruction. The probable cause of billiary obstruction in USG, CT and DC were finally confirmed by Other imaging modalities and histopathology (surgery or biopsy, FNAC).

STATISTICAL ANALYSIS:The data obtained were compiled and analyzed using standard statistical analysis. SPSS 11.5 was utilized for the data analysis and presentation. P values were calculated using chi-square test.

OBSERVATION AND RESULTS

Out of 100 cases studied, only 90 patients with obstructive jaundice were included in the present study, as the remaining 10 cases did not fulfill the inclusion criteria. This study was carried out in Department of Digestive Health & Diseases and Department of Radiology Kilpalk Medical College & Hospital from January 2008 to January 2010.

The cause and level of biliary obstruction was evaluated by Ultrasonography , CT scan of the abdomen as well as endoscopic retrograde cholangiography (ERC).

Direct cholangiography (ERC) was considered Gold standard for evaluation of level of biliary obstruction, however histopathological confirmations including FNAC, ERC –biopsy or surgical findings were the Gold standards for the evaluation of the cause of obstruction.

AGE OF THE PATIENTS:

The patients were in the age group ranging from 20-90years, the mean age was 55.2years. The largest group comprised of 50-59 years (44%) [Table- 1]

Out of 90, 34 (38%) of patients were males and 56 (62%) were females. [Table- 2]

TABLE: 1 AGE DISTRIBUTION:

AGE	MALE	FEMALE	TOTAL	**% OF STUDY POPULATION**
20-29	0	6	6	6%
30-39	1	3	4	4%
40-49	8	6	14	15%
50-59	14	23	37	41%
60-69	7	9	16	17%
70-79	4	7	11	12%
80+	0	2	2	2%
TOTAL	**34**	**56**	**90**	**100%**

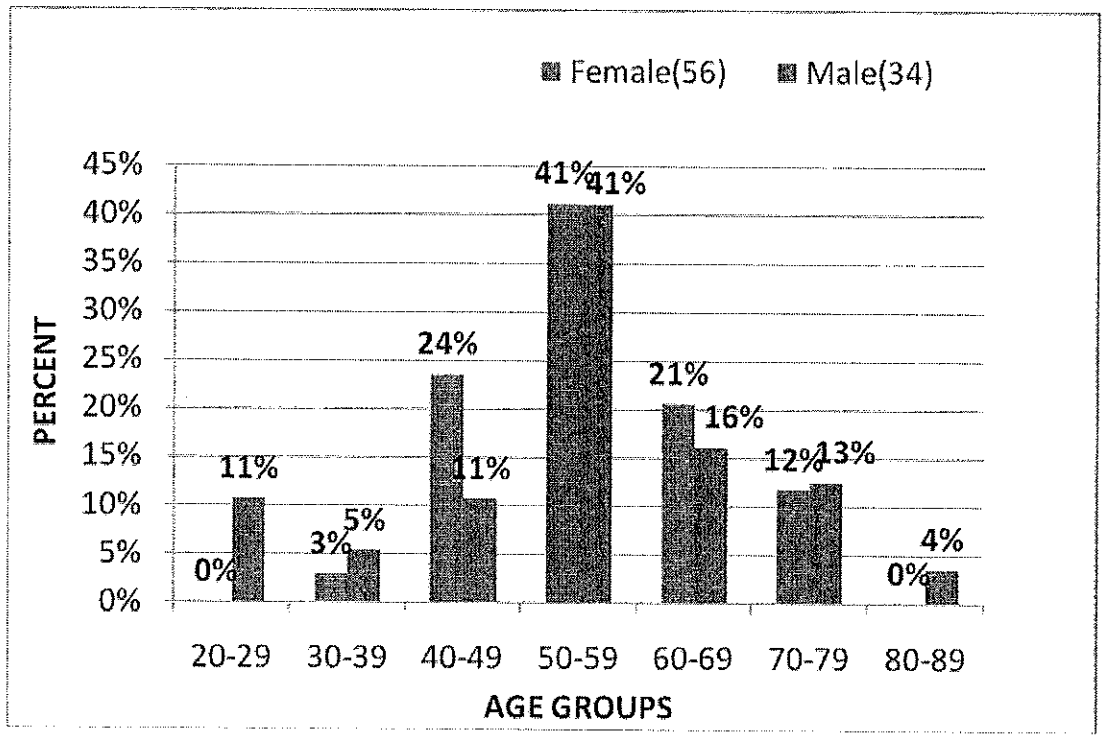
TABLE: 2 SEX DISTRIBUTIONS:

SEX	TOTAL NUMBER	% OF STUDY POPULATION
MALE	34	38%
FEMALE	56	62%
TOTAL	90	100%

CHART:I

AGE-SEX DISTRIBUTION

AGE AND SEX-WISE DISTRIBUTION OF PATIENTS



SYMPTOMATOLOGY:

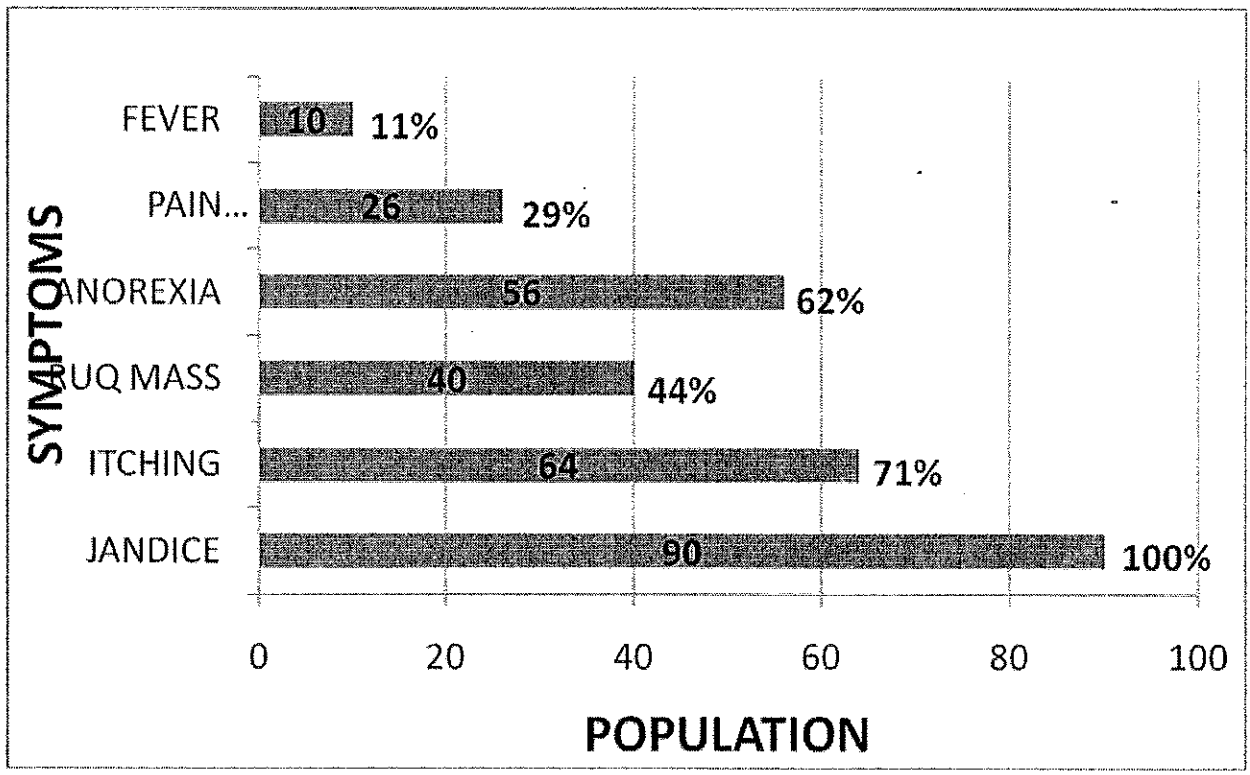
TABLE: 3 SPECTRUM OF CLINICAL PRESENTATION

CHIEF COMPLAINTS	NO. OF PATIENTS	% OF STUDY POPULATION
1.Jaundice	90	100%
2.Itching	64	71%
3.RUQ mass	40	44%
4.Anorexia	56	62%
5.Pain Abdomen	26	29%
6.Fever	10	11%

Jaundice was the major clinical feature 100% (90/90), followed by itching 71% (64/90). Anorexia was complained by 56 patients out of 90 (62%), likewise right upper quadrant mass was present in 44% (40/90) patients and 29% (26 /90) patients had pain upper abdomen. However fever was present in only 11%(10/90) patients. [Table- 3]

CHART: II CLINICAL PRESENTATION OF PATIENTS

WITH OBSTRUCTIVE JAUNDICE:



EVALUATION OF LEVEL OF BILIARY OBSTRUCTION:

All 90 patients with biliary obstruction were assessed by Ultrasonography and Computed Tomography of abdomen for evaluation of level of obstruction. ERC was regarded as gold standard for the evaluation of level of obstruction.

The validity of USG and CT in evaluation of biliary obstruction are compared to that of Direct Cholangiography in the following tables:

Table: 4 USG evaluation of Hilar (I) Obstruction;

USG (1)		Positive	Negative
	Positive	30	6
	Negative	4	50

Table 4, Shows USG was able to identify 30 cases of hilar obstruction out of 34 hence sensitivity is 88% in 95% confidence interval (30/30+4). Likewise the specificity of USG in detection of hilar obstruction was found to be 89% in 95% confidence interval. The overall accuracy of ultrasonography in evaluation of hilar level of obstruction was 89% in 95% confidence interval. These findings were statistically significant (p^{y}=0.000001).

Table: 5 USG evaluation of suprapancreatic (II) level of obstruction

USG (2)		Positive	Negative
	Positive	26	4
	Negative	4	56

The above table shows that out of 30 patients with suprapancreatic level of obstruction, Ultrasound was able to identify correct level in 26 cases giving rise to sensitivity of 87%(26/26+4) in 95% confidence interval. Ultrasound was found to have the specificity of 93%(56/56+4) in 95% CI. The overall accuracy of ultrasound in identifying the suprapancreatic level of biliary obstruction was 91%. These findings were also found statistically significant (p^{Y}=0.000005).

Table: 6 USG evaluation of intrapancreatic (III) level of obstruction

USG (3)		Positive	Negative
	Positive	20	4
	Negative	6	60

Table-6 shows USG was able to identify 18 cases of intrapancreatic level of obstruction out of 24 cases, hence it's sensitivity of 77%(20/20+6) in 95% CI, however it's specificity was found to be 94%(60/60+4) in 95%5 CI.The overall

accuracy of USG in identification of intrapancreatic level of obstruction was Found to be 89%. These findings were also statistically significant (p^F=0.00004).

Table: 7 CT evaluation of hilar (I) level of Obstruction

CT (1)		Positive	Negative
	Positive	26	8
	Negative	8	48

Table 7: shows CT scan of abdomen was able to identify the hilar level of obstruction correctly in 26 cases out of 34 patients hence it's sensitivity is 77%(26/26+8) in 95% of CI. Likewise CT was able to exclude hilar level of obstruction in 48 cases out of 56 which did not have hilar obstruction leading to specificity of 86% in 95% CI. The overall accuracy of CT scan in identification of hilar level of obstruction was 82%. The identification of hilar level of obstruction by CT scan as compared to DC was statistically significant (p^Y=0.0001).

Table: 8 CT evaluation of suprapancreatic (II) level of obstruction

CT (2)		Positive	Negative
	Positive	24	6
	Negative	6	54

The table 8 shows the CT was able to identify 24 cases of suprapancreatic level of obstruction out of 30 cases hence the sensitivity is 80% in 95% CI. The 90% specicificity in 95% CI of CT in evaluation of suprapancreatic level of obstruction tells that CT was able to exclude 54 cases out of 60 cases of biliary obstruction that did not have suprapancraetic level of obstruction confirmed later on by DC. The overall accuracy of CT in identification of suprapancreatic level of obstruction was 87%. The statistical analysis showed that CT identification of suprapancreatic level of obstruction as compared to DC was statistically significance (p^{Y}=0.00001).

Table: 9 CT evaluation in intrapancreatic (III) level of obstruction

CT (3)		Positive	Negative
	Positive	18	4
	Negative	8	56

Table 9: shows that 16 cases of intrapancreatic level of obstruction out of 24 were correctly identified by CT hence it's sensitivity is 69%(18/18+8) in

95%CI. The specificity of CT in excluding the intrapancreatic level of obstruction was 88% in 95% CI. The overall accuracy of CT in identification of intrapancreatic level of obstruction was 82%. Statistical analysis revealed that CT identification of intrapancreatic level of obstruction was statistically significant (p^F=0.002).

The following table summarizes the validity of CT scan and USG, on evaluation of level of biliary obstruction

Table: 10 Summaries of Validity of CT and USG in evaluation of level of obstruction

VALIDITY		SENSITIVITY	SPECIFICITY	ACCURACY	PPV	NPV	P-VALUE
I	CT	77%	86%	82%	77%	86%	0.0001
	US	88%	89%	89%	83%	93%	0.000001
II	CT	80%	90%	87%	80%	90%	0.00001
	US	87%	93%	96%	87%	93%	0.000005
III	CT	69%	88%	82%	69%	88%	0.002
	US	77%	94%	89%	83%	91%	0.00004

EVALUATION OF CAUSE OF BILIARY OBSTRUTION:

All the 90 patients included in this study were also evaluated with CT scan of the abdomen after USG abdomen to evaluate the cause of biliary obstruction without any knowledge of USG and DC results. The final diagnosis of all cases were obtained either by USG guided FNAC or ERC- biopsy or other imaging preoperatively. The probable cause of obstruction was divided into malignant and benign. Most likely malignant causes identified were cholangiocarcinoma, carcinoma of gallbladder, ampullary carcinoma and carcinoma of head of pancreas. Likewise the likely benign causes included choledocholithiasis, postoperative stricture of CBD or choledochal cysts. If it was difficult to identify the cause, these were labeled as indeterminate.

The validity of different imaging modalities in evaluation of cause of biliary obstruction is given below:

Table: 11 USG evaluation of cause of obstruction

a. DISEASE (MALIGNANT)

USG (MALIGNANT)		Positive	Negative
	Positive	64	6
	Negative	2	18

b. DISEASE (BENIGN)

USG (BENIGN)		Positive	Negative
	Positive	16	6
	Negative	8	60

Table11: shows that the ultrasonography correctly identified 64 cases of malignant biliary obstruction out of 66 with false negative diagnosis of one case hence its sensitivity was 97%(64/64+2) at 95% CI. The specificity of ultrasound in identification of malignant biliary obstruction was 75 %(18/18+6) at 95% CI. Overall accuracy was found to be 91%. These findings were found to be statistically significant (p^F=0.000002).

Likewise the sensitivity and specificity of USG in identification of benign biliary obstruction were 67% and 91% at 95% CI respectively. The overall accuracy of ultrasound in identification of benign biliary obstruction was 71%.

Table 12: CT evaluation of cause of obstruction

a. DISEASE (MALIGNANT)

CT (MALIGNANT)		Positive	Negative
	Positive	60	4
	Negative	6	20

b. DISEASE (BENIGN)

CT (BENIGN)		Positive	Negative
	Positive	18	8
	Negative	6	58

Table12 (a) shows that CT has sensitivity of 91% (60/60+6) at 95% CI and specificity of 83%(20/20+4) at 95% CI. The overall accuracy of CT abdomen in identification of malignant cause of biliary obstruction was 89%. The statistical analysis showed the finding to be statistically significant (p^F= 0.000005).

Likewise Table 12 (b) shows that the sensitivity and specificity CT abdomen in identification of benign causes of biliary obstruction was 75% and 89% respectively at 95% CI. The overall accuracy was 84%.

Table 13: DC evaluation of cause of obstruction

a. DISEASE (MALIGNANT)

		Positive	Negative
ERC (MALIGNANT)	Positive	64	10
	Negative	2	14

b. DISEASE (BENIGN)

		Positive	Negative
ERC (BENIGN)	Positive	16	4
	Negative	8	62

Table 13 (a) shows that the DC (ERC) was able to identify 64 cases of malignant biliary obstruction out of 66 patients, hence it's sensitivity was97 % (64/64+2) at 95% CI. The specificity was 58% (14/14+10) in 95% CI. The overall accuracy of DC in identification of malignant biliary obstruction was 87%. These findings were found to be statistically significant (p^F=0.0001)

As per table 13(b), the sensitivity and specificity of direct cholangiogram in identification of benign causes of biliary obstruction were 67% and 94% respectively at 95% CI.

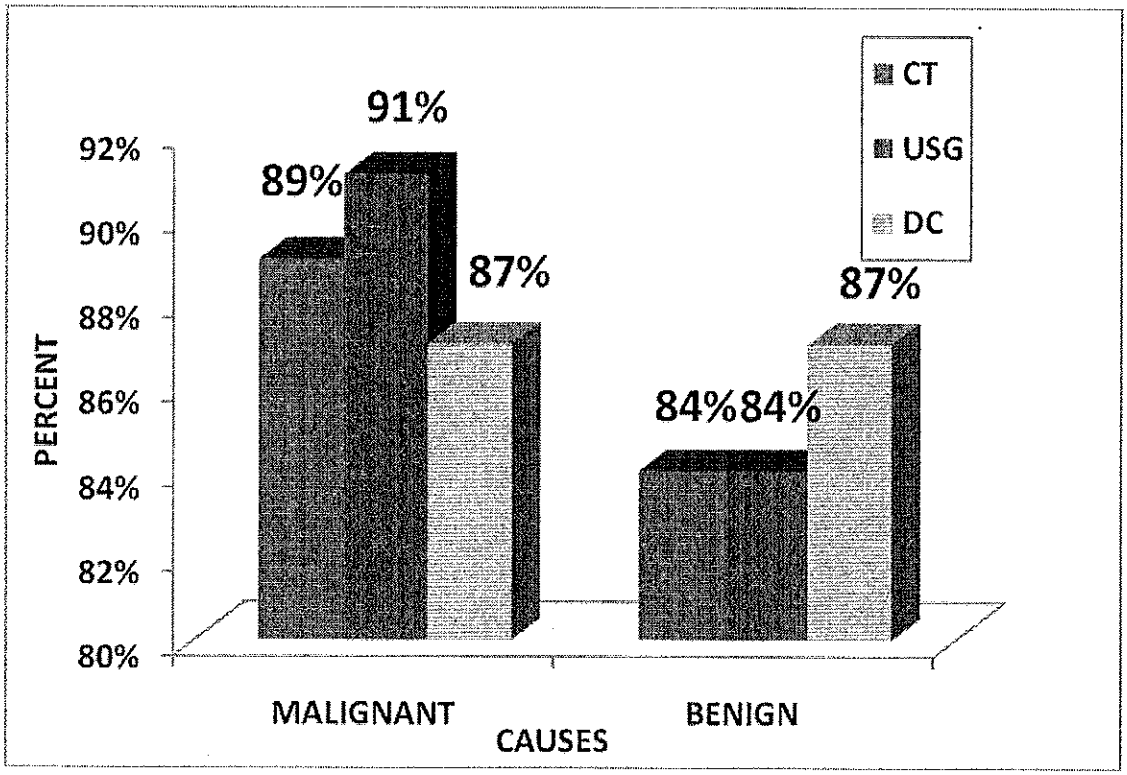
Table 14: Final diagnosis of biliary obstruction

CAUSES	NO OF PATIENTS	% OF TOTAL CASES
Cholangiocarcinoma	24	26.66%
Carcinoma of GB	12	13.33%
Carcinoma of Head of Pancreas	8	8.86%
Ampullary carcinoma	22	24.5%
Choledocholithiasis	16	17.77%
Postoperative stricture	4	4.44%
Choledochal cyst	4	4.44%
Indeterminate	-	
TOTAL	90	100%

Table 14: shows that out of 90 patients 73.3% (66/90) had malignant cause of biliary obstruction and remaining 26.7% (24/90) had benign etiology. Among the malignant causes of biliary obstruction 26.6% (24/90) patients had cholangiocarcinoma followed by ampullary carcinoma in 24.5% (22/90) cases, carcinoma of gallbladder 13.33%(12/90) cases, and lastly the carcinoma of head of pancreas in 8.8% (8/90) cases.

Likewise choledocholithiasis was the number one cause of benign biliary obstruction comprising 17.7%(16/90) of patients followed by postoperative strictures and choledochal cysts in 4.4% (4/90) of patients in each.

ACCURACY OF DIFFERENT IMAGING MODALITIES IN IDENTIFICATION OF CAUSES OF OBSTRUCTION



DISCUSSION

Evaluation of patients with bile duct obstruction frequently involves the stepwise performance of several imaging techniques. The aim of these investigations is to provide sufficient diagnostic and anatomic information to allow appropriate treatment. Such information includes the level and cause of biliary obstruction in addition to assessment of tumor resectability in malignant cases.[7]

The purpose of this study was to evaluate the level and causes of biliary obstruction in patients with obstructive jaundice by various imaging modalities including Ultarsound, CT Scan and Direct Cholangiography.Patients with features of obstructive jaundice were included in this study. The USG, CT and DC were performed within two weeks and interpreted separately. There are no previous studies of this kind, which had included the different imaging modalities (USG, CT, DC) in evaluation of biliary obstruction in South Indian population.

Several pathways have been suggested for the radiological evaluation of the patients with suspected bile duct obstruction 68.

Most of these use USG as the initial modality to confirm or exclude biliary obstruction, which it does with at least 90% accuracy[69,70.]

CT is similarly accurate but less ideal as a screening test because it is more expensive and less widely available. Most of the studies comparing USG and CT have been retrospective, however, only a few prospective studies have been

reported[7,20].In one of these studies[7] USG correctly indicated the level of obstruction in 60% and the cause in 38%, compared with 88% and 70% respectively for CT.

ERCP is the most appropriate imaging modality for investigation of postcholecystectomy syndrome and common bile duct calculus 67 and it has the accuracy rate of 86%. USG and CT are also correct in the diagnosis of choledochal cyst with similar sensitivity and accuracy 15.

In the present study complete radiological evaluation of 90 patients was performed. Out of them 34(38%) were males and 56(62%) were females. The mean age of the patients was 55.2 years (26 – 86 years). The maximum numbers of subjects were between 50-59 years of age.

Here the level of biliary obstruction was divided into hilar (I), suprapancreatic (II) and intrapancreatic (III) levels. Hilar level of obstruction was level of obstruction at or above the porta hepatis including the proximal part of common hepatic duct. Suprapancreatic level was defined as the level of obstruction from lower limit of hilar level to upper border of head of pancrease, similarly intrapancreatic level was the distal most level of

obstruction involving the pancreatic and ampullary region of common bile duct.

The causes of biliary obstruction were divided into malignant and benign. Malignancy is one of the most common causes of biliary obstruction 44. USG demonstrated the cause in 90% and level of obstruction in 96% of patients, which is comparable to our study. The effectiveness of USG has been shown in

various studies29, 67.

The most common level of obstruction was hilar and was seen in 34(38%) patients followed by suprapancreatic in 30(33.3%) patients and intrapancreatic level in 26(28.7%) patients. Similarly most of the patients (73%) had malignant cause of biliary obstruction.

Similarly 66(73%) patients had malignant causes of biliary obstruction and 24 patients (27%) had benign etiology of biliary obstruction.

The accuracy of ultrasound in identification of correct level of obstruction was 91% and it was 83% for CT scan. The sensitivity of ultrasound for identification of hilar, suprapancreatic and intrapancreatic levels of obstruction were 88%, 87% and 75% respectively. Similarly CT has sensitivity values of 77%, 80% and 67% for identification of hilar, suprapancreatic and intrapancreatic levels of obstruction respectively.

The accuracies of ultrasound, CT scan and direct cholangiograms in identification of malignant biliary obstruction were 91%, 89% and 87% respectively. However the sensitivity of both ultrasound and direct cholangiograms were higher (both have 97% sensitivity) than the CT scan.

Most common cause of malignant obstruction was found to be cholangiocarcinoma in 24 patients (26.6%) followed by ampullary carcinoma in 22 patients (24.5%), carcinoma of gallbladder in 12 patients (13.3%), and carcinoma of head of pancreas in 8 patients (8.8%).

Among the benign biliary obstructions choledocholithiasis was found in 16 patients (17.7%), postoperative stricture in 4 (4.4%) and choledochal cysts in 4(4.4%)patients.

USG correctly identified the cause of obstruction with the accuracy of 91%(87% for DC) and CT showed the accuracy of 89% in identifying the cause of obstruction. The probable reasons behind this could be that for every patient spiral CT could not be done and majority of patients with advance disease had multiple lymphadenopathy at presentation hence differentiation of mass from lymph nodes was difficult in some patients.

The better results of USG examination in our study could be due to improvement in the re solution USG and secondly due to predominance of hilar obstruction in the study population. Hilar obstruction is better visualized in ultrasound as liver provides a good acoustic window and the fact that decreased amount of subcutaneous fat in the population studied could have played positive role in proper visualization of hepatobiliary system.

The statistical analysis of the study was found to be statistically significant (PValue<0.05) for both level as well as cause of obstruction.

The present study showed correct identification of level of obstruction by USG and CT in 91% and 83% respectively. Likewise the accuracy in identification of malignant cause of biliary obstruction was 91% for USG, 89% for CT and 87% for Direct Cholangiograms. These findings are similar as that of Robert N. Gibson et al[29]. In their study of 65 patients, all underwent USG, 51 had CT scan

of abdomen and direct cholangiography was done in 57 patients. They had found that USG in 95% of cases and CT in 90% correctly identified the level of obstruction. The cause was correctly identified by USG in 88%, by CT in 63%and by DC in 89%.

The retrospective study of Fay C. Laing et al 16 had shown the correct identification of the level and cause of biliary obstruction by USG in 91.8% and 70.9% of patients respectively. The present study also showed higher rate of identification of cause of biliary obstruction by USG (91%).

This study differed from the study of CS Pedrosa et al [39,40] where CT was performed in 67 patients of obstructive jaundice. The accuracy in determining the exact level and cause of obstruction has been 97% and 94% respectively. Our study showed lower accuracy of CT in determination of level (83%) and cause (89%).

The study of S.Pradhan, R.K.Ghimire et al [71] had found the most common cause of biliary obstrution to be common bile duct calculus (54.5%) followed by cholangiocarcinoma (26,6%) and carcinoma of pancrease (7%). The sensitivity of USG in identifying the level and cause of obstrution was 80.6%and 42% respectively.

The higher accuracy of USG of present study for the level (90.6 %) and cause (91 %) of biliary obstruction could be because of higher resolution of USG machine and because of experienced Radiologist.

The present study showed the most common cause of biliary obstrution was neoplastic, namely cholangiocarcinoma, however choledocholithiasis was still the most common benign cause of biliary obstrution.

Finally this study showed that USG, CT and DC have almost similar accuracy in evaluation of level and cause of biliary obstruction. It was also seen that DC provided little or no additional information over USG or CT in identification of the level and cause of the biliary obstruction

If USG is combined with with CT, more accurate diagnosis of biliary obstruction can be achieved.

It can be suggested that ERC may be avoided in these patients. These modalities are reserved for those patients where cholangiography is required to assess tumor resectability or therapeutic drainage is required as these modalities are invasive and have major complications. The reported rate of complications ranges from 2—4%. [30,31.]

SUMMARY AND CONCLUSION

The present study was undertaken to study the accuracy of different imaging modalities namely Ultrasound, Computerized Tomography and Endoscopic Retrograde Cholangiography (ERC) in evaluation of level and cause of biliary obstruction. The study was carried out in the Department of Digestive Health & Diseases and Department of Radiology, Kilpauk Medical Collage and Hospital from January 2008 to January 2010.

*There were 90 patients in the study group out of which 34 (38%) were males and 56(62%) were females. The age of the patients ranges from 26 to 86 years, mean age was 55.2 years.

*Jaundice was the presenting symptom in 90 patients (100%). It was followed by itching in 64(71%) patients, anorexia in 56(62%) patients and right upper quadrant mass in 40(44%) patients. Other symptoms were pain abdomen and fever in 26 (27%) and 10(11%) patients respectively.

*All the 90 patients underwent Ultrasound, CT scan and Direct Cholangiography (ERC) at different times within two weeks period.

* Final diagnosis was obtained either by USG guided FNAC or ERC-biopsy/cytology or by surgery or by other imaging modalities like MRI and MRCP.

*There were 34 patients with hilar level of obstruction, which were correctly identified by USG in 88% cases and by CT Scan in 77% of cases. The suprapancreatic level of obstruction was observed in 30 patients out of which USG correctly identified 87% 0f cases and CT did it with 80% sensitivity. Likewise out of 24 patients with intrapancreatic obstruction, USG correctly identified 75% of cases and CT identified 67% of cases correctly.

*The accuracy of USG, CT and DC in identification of cause of malignant biliary obstruction was 91%, 89% and 87% respectively and for the identification of benign cause of biliary obstruction it was 84%, 84% and 87% respectively.

*Cholangiocarcinoma was the most common cause of malignant biliary obstruction seen in 24 patients (26.6%) followed by ampullary carcinoma in 22(24.5%), carcinoma of gallbladder in 12(13.3%) and carcinoma of head of pancrease in8 (8.8%) of patients.

*Choledocholithiasis was the most common benign cause of biliary obstruction in the present study. Postoperative stricture was seen in 4(4.4%) patients likewise 4(4.4%) patients had choledochal cyst.

*The findings of all the imaging modalities (USG, CT and DC) in the present study regarding the evaluation of the level and cause of biliary obstruction were found statistically significant.

The present study has shown that the overall accuracy in identification of level and cause of biliary obstruction is more or less similar with the USG, CT as well as DC. Considering the cost, availability and risks of invasive procedures, USG should be the first choice of investigation in suspected biliary obstruction followed by by other imaging modalities as and when required. Invasive modalities should be reserved for those patients where therapeutic interventions are required.

Appendix - I

REFERENCES

1. Oxford handbook of clinical medicine, third edition

2 David Sutton, Textbook of Radiology and Medical Imaging, Sixth edition

3. R.G.Grainger, D.J.Allison, A. Adam, A.K.Dixon.Grainger And Allison's Diagnostic Radiology, A textbook of Medical Imaging.Vol.2 Fourth Edition.

4.R.G.Grainger and Allison's Diagnostic Radiology 3rd edition. Churchill Livingstone 1999,1215.

5.Medical Encyclopedia—Health Information 2000.

6.Faye C. Laing, R.Brooke, Jeffrey Jr, Vivian W.Wing et al ----Biliary Dilatation—Defining Level and cause by real time USG, 1986; 160:39—42.

7.Baron RL, Stanley RJ, Lee JT et al: A Prospective comparision; Evaluation of biliary obstruction using USG and CT: Radiology 1982:145; 91—98.

8.Cooperberg PL, High Resolution real time ultrasound in the evaluation of normal and obstructed biliary system Radiology-1978, 129, 477—480.

9.Shieh CJ, Dunn E, standard; Primary carcinoma of gallbladder: a review of 16 years experience at the Waterbury Hospital health center. Cancer 1981:47; 996—1004.

10.Piehler JM, Crichlow RW: Primary carcinoma of gallbladder. Surg Gynecol Obstet 1978:147:929—942.

11.Yeh HC. Ultrasonography and computed tomography of carcinoma of gallbladder: Radiology 1979:133; 167—173.

12.Raghavendra BN.Ultrasonographic features of primary carcinoma of the gallbladder; report of five cases; Gastrointest Radiol 1980; 5:239—244.

13.Dalla Palma L, Rizatto G, Pozzi Mucelli, and RSBazzochi M: Grey scale Ultrasonography in the evaluation of the carcinoma of the gallbladder. Br.J.Radiol 1980; 53:662—667.

14.Allibone GW, Fagan CJ, Porter SC.Sonographic features of carcinoma of the gallbladder. Gastrointest Radiol 1981; 6:169—173.

15.C. Rumack, R.Willson, J.William—Diagnostic Ultrasound Vol I 1991,133—134.

16.Kouji Morimoto, Mutsuo Shimojo, Toyomi Shirakawa et al. Biliary Obstruction, evaluation with 3 D MR Cholangiography 1992,183:578—580.

17.Lopera JE, Soto JA, Munera F [2001]. Malignant hilar and a perihilar biliary obstruction; use of MR cholangiography to define the extant of biliary ductal involvement and percutaneuos intervention. Radiology 1984 220: 90— 96.

18.Manorama Berry, Veena Chaowdhary, Sudha Suri.Hepatobiliary and Gastrointestinal imaging 1997p.69.

19.Tio TL, Tutgal Gas.Endoscopic USG of bile duct malignancy and preoperative assessment of local respectability .Gastrointestinal Imaging 1989; 12:151—157.

20.Honickmum SP, Mueller PR, Mittenberg J et al. Ultrasound in obstructive jaundice—prospective Evaluation of site and causes. Radiology 1983; 147:511—515.

21.Manorama Berry, Veena Chaowdhary, Sudha Suri.Hepatobiliary and Gastrointestinal Imaging 1997 p.70—73.

22.William E.Brant. Fundamental of Diagnostic Radiology, Imaging methods of biliary tree 2nd edition 1998.679—681.

23.Iglehart J.D.Sabiston DC.textbook of Surgery 14th edition. WB Saunders Company, 1991 Philadelphia.

24.Barry B.Goldberg and Alfred B.Kurtz.An Atlas of USG 1990.

25.Interpreting CT Head Scans; a basic guide to image analysis, L.E.Albertyn, RV Brown, page 4.

26.An Atlas of Anatomy Basic to Radiology, Vol.II, IsadoreMeshan page 888—890.

27.Basic Pathology. Kumar, Cotran, Robbins, 5th edition. Page 524—526.

28.William L.Campbell.Medical versus Surgical jaundice .152—155.

29.Robert N.Gibson, Eugene Yeung, Jeremy N.Thompson, Denis H.Carr, Anne P.Hemingway, Howard A.Bradpiece, Irving S.Benjamin, Leslie H.Blumgart, David J.Allison.Bile duct obstruction: Radiologic Evaluation of Level, Cause and Tumor resectability. Radiology 1986; 160:43—47.

30.Cotton PB.Progress report; ERCP.Gut1977; 18:316—341.

31.Gibson RN.Percutaneous Transhepatic Cholangiography.In; Surgery of the liver and biliary tract. Edinberg: Churchill Livingstone, 1986.

32.Laing FC, Jeffrey RB, Wing VW.Improved visualization of choledocholithiasis by sonography. AJR 1984; 143:949—952.

33.Thompson JN, Blungart LH.Post—cholecystectomy syndrome. In: CameronJ ed. Current Surgical therapy. Philadelphia: 1986.

34.Gross BH, Hanter LP, Gore RM et al. US evaluation of CBD stone: Prospective evaluation with ERCP—Radiology 1983,146:471—474.

35.Laing FC, Jeffery RB, Wing VN.Improved visualization of choledocholithiasis by sonography. AJR 1984; 143:949—952

36. 36.Richard L.Baron, Robert J. Stanley, Joseph K. T.Lee, Robert E.Koehler, Robert G, Levitt; Computed Tomographic features of biliary obstruction: AJR 140:1173-1178,June 1983

37. Shanser JD, Korobkin M.GoldbergHI, Rohlfing B M. Computed tomographic diagnonosis of obstructive jaundice in the absence of intrahepatic ductal dilatation. A J R 1978; 1031: 389-392.

38. Zeman R K, Dorfman G S, Burrel M I, StinS, Berg G R, Gold G A. Disparate dilatation of intrahepatic and extra hepatic bile ducts in surgical jaundice. Radiology 1981; 138:129-136.

39. Pedrosa C S, Cusanova R, Lezana A H, Fernandez M C. Computed tomography in obstructive jaundice: Part I .The level of obstruction. Radiology 1981; 139:627-634.

40. Pedrosa C S, Cusanova R, Lezana A H, Fernandez M C. Computed tomography in obstructive jaundice. Part II: The cause of obstruction. Radiology 1981; 139:635-645.

41. Ricardo Robledo MD et al. carcinoma of the hepaticopancreatic ampullar region : Role of US. Radiology 1988; 166:409-412.

42. Weinstein B J, Weinstein D P. Sonographic anatomy of pacrease. Semin ultracound 1980; 1(3): 156-165

43. Joan P. Campbell, M.D, FRCP, Stephanie R. Wilson MD< FRCP: Pancreatic neoplasms: How useful is evaluation with US? Radiology 1988; 167: 341-344

44. Recardo Robledo, Aventano Muro, Maria Luisa, Prieto. Extrahepatisc bile duct carcinoma --US characteristic and accuracy in demonstration of Tumour.AJR 1996, 198:869- 875

45. Sally E, Mitchell. Robert A. Clark. A Comparison of computed tomograpy and sonography in choledocholithiasis. AJR 142: 729-733,April 1984

46. Bethan M, Kazan E. Sonography of common bile duct: value of the right anterior oblique view. AJR1978; 130:701-709

47. Gold R P, Casarella W J, Stein J, Seaman W B. Transhepatic cholangiography: the radiologic method of choice in obstructive jaundice. Radiology 1981; 139:635-645

48. Cronan JJ, Mueller P R, Simeone J F, et al. Prospective diagnosis of choledocholithiasis. Radiology 1983; 146:467-469

49. Gross B H < Harter L P, Gore R M, et al. Ultrasonic evaluation of common bile duct stone: Prospective comparison with endoscopic retrograde cholangiopancreatography. Radiology 1983; 146:471-474

50. Baron R L, Stanley R G, Lee JKT, Koehler R E, Levitt RG. Computed tomographic features of biliary obstruction. AJR 1983; 140:1173-1178

51. Jeffrey R B, Federale M P, Laing F E, Wall S, Rego J, Moss AA. Computed Tomography of choledocholiathiasis. AJR 1983; 140:1179-1183

52. Arnold C, Friedman, Leroa Sach and Mark T, Birns. Radiology of jaundice including choledocholithiasis and biliary neoplasms

53. C Rumack, R. Wilson, J. William diagnostic ultrasound Volume 1. 1991,132-154

54. Threasa H. Reiman, MD. Denis M Balfe, MD. Philip J, Weymen, MD. Suprapancreatic biliary obstruction: CT evaluation Radiology 1987; 163:49-56.

55. Takashi KO Kubo, Yuj Itai and Kuni Ohtomo et al. Mucin hyper secreting intrapancreatic biliary neoplasm. Radiology 1988; 168:609-614

56. M. Kristen Thorsen, MD. Francisco Quiroz, MD. Thomas L. Lawson, MD. David F. Smith. W Dennis, Folley, Edward T. Stewart. Primary biliay carcinoma CT Evaluation.Radiology1984; 152:479—483.

57.John T. Engels, Dennis M.Balfe, and Joseph K.T.Lee.Biliary Carcinoma: CT Evaluation of Extra hepatic spread. Radiology 1989; 172:35—40.

58.Shelly Nan Weiner, Mordecai Koenigsberg, Helen Morehouse, and Janet Hoffman: Sonography and Computed Tomography in the Diagnosis of carcinoma of the gallbladder. AJR 142:735—739,April 1984.

59. Shieh CJ, Dunn E, Standard JE.Primary carcinoma of gallbladder: a review of a16 year experience at the Waterbury Hospital Health center. Cancer 1981; 47:996—1004.

60.Piehler JM, Crichlow RW.Primary carcinoma of gallbladder. Surg Gynecol Obstet 1978; 147:929—942.

61.Yeh HC.Ultrasonography and computed tomography of carcinoma of gallbladder. Radiology 1979; 133:167—173.

62.Dalla Palma L, Rizzatto A, Pozzi Mucelli RS, Bazzochhi M.Grey-scale ultrasonography in the evaluation of carcinoma of the gallbladder.Br.J.Radiol 1980; 53:662—667.

63.Olken SM, Bledsoe R, Newmark H.The ultrasonic diagnosis of primary carcinoma of gallbladder. Radiology 1978; 129:481—482.

64.Yum HY, Fink AH.Sonographic findings in primary carcinoma of the gallbladder. Radiology 1980; 134:693—696.

65.Khurram M, Durrani AA, Hasan Z, Butt AA, Ashfaq S: Endoscopic retrograde cholangiopancreatographic evaluation of patients with obstructive jaundice.J.Coll Physicians Surg Pak.2003 June; 13(6): 325—328.

66.Daine K.Huntington, Michael C.Hill William Steinberg-Biliary Tract Dilatation in chronic pancreatitis. CT and USG findings. 1989; 172:47-50.

67.Cronanj.USG of choledocholithiasis; a repraisl; Radiology 1996; 161; 133-134.

68.Ring EJ, Her Linger H, Gordon RL.Radiology in jaundice. In: Herlinger H, Lunder quist A, Wallace S, eds. Clinical RADILOGY of the liver. Newyork: Dekker, 1983; 611-643.

69.Koenigsberg M.Weiner SN.Walzer A. Diagnosis of obstructive jaundice: a comparison with cholangiography. Radiology 1979; 133:157-165.

70.Ferrucci JT.Adson ma, Mueller PR, Stanley RJ, Steward ET.Advances in the radiology of jaundice: a symposium and review. AJR 1983; 141:1-20.

71.Pradhan S, Ghimire RK, et al. Evaluation of obstructive jaundice, International symposium TUTH/JICA-1994: 1-25.

CASE PROFILE [PROFORMA]

DDHD NO: DATE OF EXAMINATION:

WARD:

PARTICULARS OF THE PATIENTS:

Name: Age/Sex Occupation:

Smoking Yes No

Alcohol Yes No

TREATMENT HISTORY

SPECTRUM OF CLINICAL PRESENTATION:

1) Jaundice
2) Anorexia
3) Asthenia
4) Palpable RUQ mass
5) Past H/O jaundice
6) H/O Surgery, Relevant Medical Problems

LABORATORY FINDINGS

I. LFTS

a. Total Bilirubin

b. Direct Bilirubin

c. SGOT

d. SGPT

e. Alk.phos

f. PT

II. HEMATOLOGY

a. Hb

b. ESR

III. HbsAG

IV. HIV (ELISA)

V. Anti HCV Ab

ULTRASONOGRAPHIC FINDINGS:

I LEVEL OF OBSTRUCTION

a. Hilar b. Suprapancreatic c. Intrapancreatic

II CAUSE OF OBSTRUCTION

a. Malignancy	b. Benign
• Cholangiocarcinoma	Choledocholithias
• Carcinoma of gallbladder	Postope stricture
• Carcinoma of head of pancrease	Pancreatitis
• Others e.g. Mets/HCC	Choledocal cyst

CT FINDINGS:

I. LEVEL OF OBSTRUCTION

a. Hilar b. Suprapancreatic c. Intrapancreatic

II. CAUSE OF OBSTRUCTION

a. Malignancy	b. Benign
Cholangiocarcinoma	Choledocholithiasis
Carcinoma of gallbladder	Postope stricture
CA head of pancrease	Pancreatitis
Others e.g. Mets/ HCC	Choledocal cyst

DIRECT CHOLANGIOGRAPHIC FINDINGS [ERCP]

I. LEVEL OF OBSTRUCTION

a. Hilar b. Suprapancreatic c. Intrapancreatic

II. CAUSE OF OBSTRUCTION

a. Malignancy	b. Benign
Cholangiocarcinoma	Choledocholithiasis
Carcinoma of gallbladder	Postope stricture
Carcinoma of head of pancreas	Pancreatitis
Others e.g. Mets/HCC	Choledocal cyst

OTHER HIGHER IMAGING FINDING

CYTOLOGY/HISTOPATHOLOGICALFINDINGS/OPERPERATIVE

Appendix - II

Figure -1 CT Scan –Dilated IHBR in a case Hilar Cholangiocarcinoma

Figure -2 ERCP-Showing CBD Stricture-Post of OP Stricture

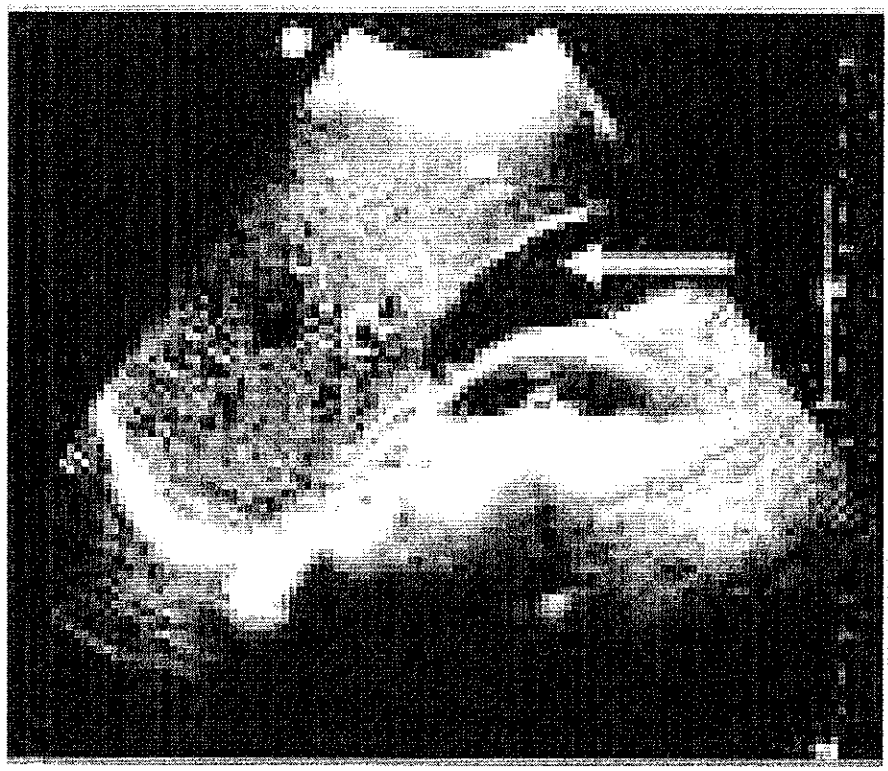


Figure -3 USG Showing Distended Gallblader –A case of mid CBD stricture

Figure -4 ERCP showing CBD calculus

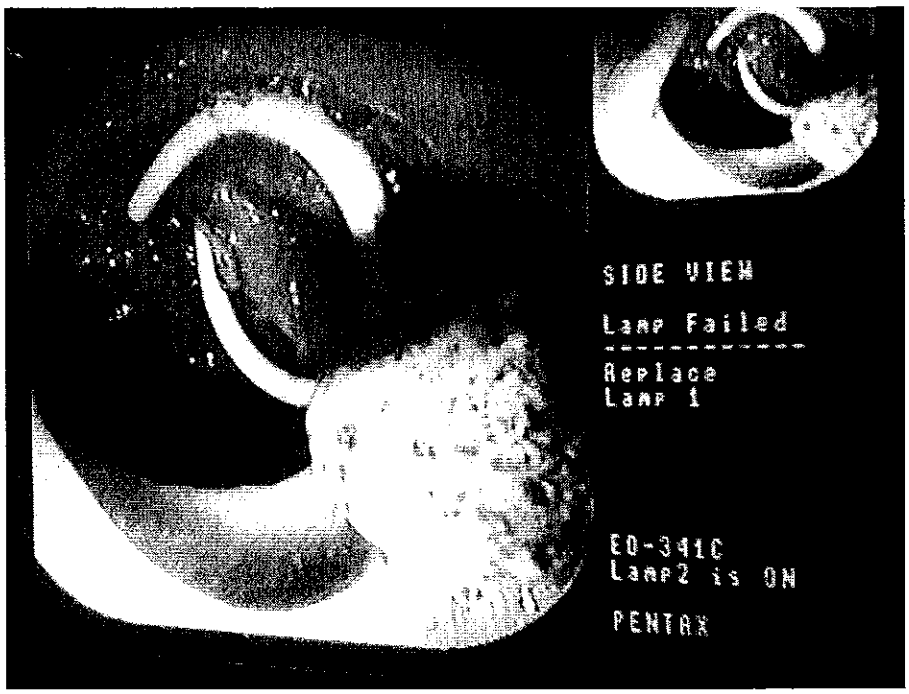


Figure -5 Side Viewing Scopy showing Calculus with Biliary Stent

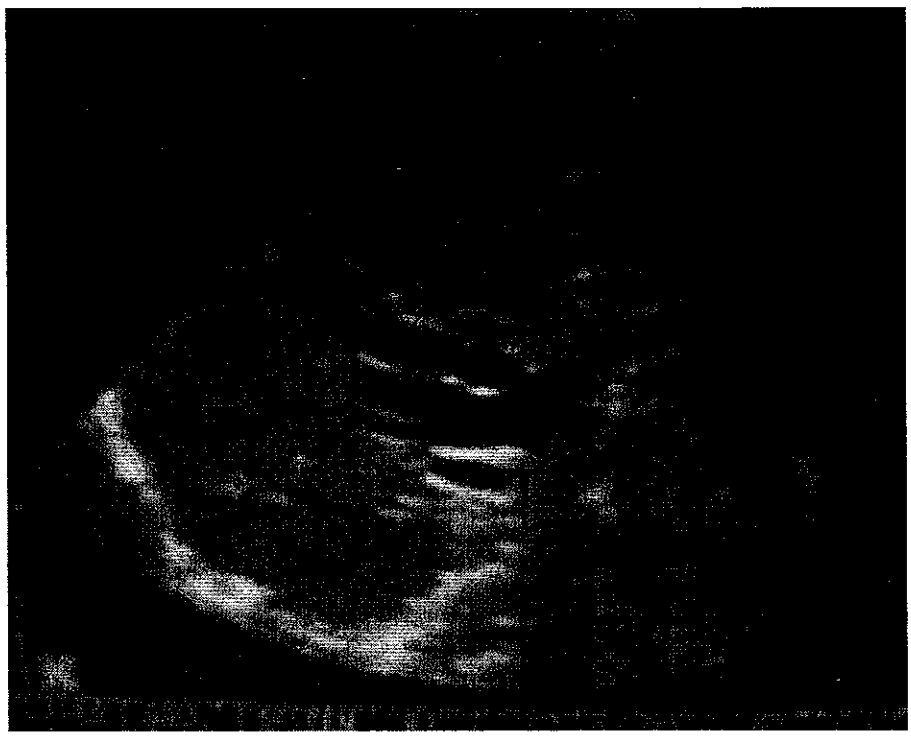


Figure -6 USG –Dilated IHBR in the case of Distal Cholangiocarcinoma

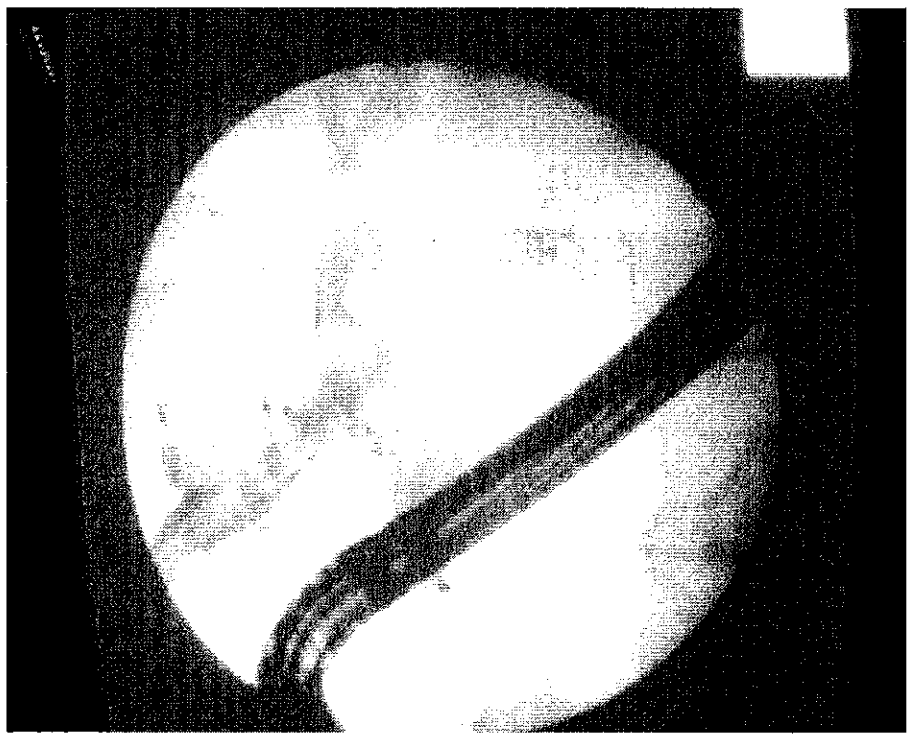


Figure -7 ERCP–Multiple CBD Calculi

Appendix - III

SL NO	Name	AGE	Sex	Group	DDHD NO	CLINICAL PRESENTATION						USG ABDOMEN		CT SCAN ABDOMEN		ERC		FINAL DIAGNOSIS
						JAUNDICE	ITCHING	RUQ MASS	ANOREXIA	PAIN ABDOMEN	FEVER	LEVEL OF OBSTRUCTION	CAUSE OF OBSTRUCTION	LEVEL OF OBSTRUCTION	CAUSE OF OBSTRUCTION	LEVEL OF OBSTRUCTION	CAUSE OF OBSTRUCTION	
1	ANJAMMAL	58	F	50-60	3318/08	+	-	-	+	+	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
2	VEERAMMAL	78	F	70-80	4014/09	+	+	+	+	-	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
3	PANCHARATHANAM	76	M	70-80	6223/09	+	+	+	+	+	-	NAD	NAD	NAD	NAD	I	CAPH	CA HEAD OF PANCREAS
4	MAHALAKSHMI	57	F	50-60	7132/09	+	-	+	+	-	-	I	NAD	NAD	NAD	I	AC	AMPULLARY CARCINOMA
5	NALINI	24	F	20-30	2625/08	+	+	+	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
6	GURUVAYYA	58	M	50-60	6182/08	+	-	-	+	+	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
7	MEERABAI	71	F	70-80	2140/08	+	+	+	+	-	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
8	KAMALAM	59	F	50-60	4078/08	+	+	+	+	+	-	I	CAPH	I	CAPH	I	CAPH	CA HEAD OF PANCREAS
9	MEGAMMAL	58	F	50-60	604/08	+	-	+	+	-	-	NAD	NAD	NAD	NAD	I	AC	AMPULLARY CARCINOMA
10	NIVEDHA	24	F	20-30	1641/08	+	+	+	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
11	KUPPAMMMAL	68	F	60-70	5551/08	+	-	+	+	-	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
12	JAYALAKSHMI	75	F	70-80	3014/09	+	-	+	+	-	-	NAD	NAD	NAD	NAD	H	CAGB	GB CANCER
13	MARIMUTHU	64	M	60-70	4397/08	+	+	+	+	+	-	I	CAPH	I	CAPH	I	CAPH	CA HEAD OF PANCREAS
14	SAROJA	59	F	50-60	4218/08	+	-	-	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
15	RADHA	26	F	20-30	731/09	+	+	+	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
16	THANGAPAPPA	67	F	60-70	5983/09	+	-	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
17	JABER	59	M	50-60	4544/08	+	+	-	+	+	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
18	CHANDRAN	65	M	60-70	5451/08	+	+	+	+	+	-	NAD	NAD	I	CAPH	I	CAPH	CA HEAD OF PANCREAS
19	SARALA	58	F	50-60	508/08	+	-	-	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
20	SRIMATHI	28	F	20-30	1714/09	+	+	-	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
21	THANGAVEL	68	M	60-70	165/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
22	VELLAI	56	M	50-60	2805/10	+	+	+	+	+	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
23	ANTHONIRAJ	69	M	60-70	5893/08	+	+	+	+	+	-	S	CAPH	NAD	NAD	S	CAPH	CA HEAD OF PANCREAS
24	KUMUDHA	53	F	50-60	8140/08	+	-	-	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
25	NEELA	25	F	20-30	9140/09	+	+	-	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
26	SEETHALAKSHMI	56	F	50-60	61/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
27	BAGGIYAM	68	F	60-70	2486/08	+	+	+	+	+	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
28	NARAYANASAMY	69	M	60-70	6442/09	+	+	+	+	-	-	S	CAPH	NAD	NAD	S	CAPH	CA HEAD OF PANCREAS
29	VELLAIMMAL	57	F	50-60	6410/08	+	+	-	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
30	GOWRI	32	F	30-40	3124/08	+	+	-	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
31	SAIPRIYA	55	F	50-60	354/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
32	KAMALA	67	F	60-70	2652/10	+	+	+	+	+	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
33	RAJENDRAN	72	M	70-80	6742/09	+	+	-	+	-	-	NAD	NAD	NAD	NAD	I	CAPH	CA HEAD OF PANCREAS
34	VANAJA	57	F	50-60	1314/09	+	+	-	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA

						CLINICAL PRESENTATION						USG ABDOMEN		CT SCAN ABDOMEN		ERC		
35	REKHA	34	F	30-40	1170/08	+	-	-	+	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
36	ANITHA	56	F	50-60	6171/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
37	PUSHPARATH	68	F	60-70	6220/10	+	+	+	+	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
38	KAMALA	76	F	70-80	7140/09	+	+	-	-	-	-	NAD	NAD	NAD	NAD	I	CAPH	CA HEAD OF PANCREAS
39	VERALAKSHMI	81	F	80-90	1801/09	+	+	-	-	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
40	DEVIPRIYA	38	F	30-40	2756/10	+	-	-	-	+	-	S	CDL	S	CDL	NAD	NAD	CHOLEDOCHOITHIASIS
41	ALAMELU	58	F	50-60	6185/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
42	PATCHIMAL	59	F	50-60	1764/10	+	+	+	+	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
43	PICHAIKANI	56	M	50-60	3318/08	+	-	+	+	-	+	NAD	NAD	NAD	NAD	S	POS	POST OP STRICTURE
44	GANGA	86	F	80-90	2797/08	+	+	-	-	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
45	GAJENDRAN	45	M	40-50	356/09	+	-	-	-	+	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
46	MAHALKSHMI	62	F	60-70	4761/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
47	PARVATHY	58	F	50-60	1818/08	+	+	+	+	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
48	KUMARAVADIVEL	52	M	50-60	6079/09	+	+	-	-	-	+	H	POS	H	POS	H	POS	POST OP STRICTURE
49	PRABHU KUMAR	59	M	50-60	2581/08	+	+	-	-	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
50	VENKATESAN	43	M	40-50	653/09	+	-	-	-	+	-	H	CDL	H	CDL	H	CDL	CHOLEDOCHOLITHIASIS
51	SAROJA	63	F	60-70	5140/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
52	DEIVAYANAI	57	F	50-60	2059/09	+	+	+	-	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
53	GANESAN	46	M	40-50	5913/09	+	+	-	-	-	-	H	POS	H	POS	H	POS	POST OP STRICTURE
54	SEBASTIAN	53	M	50-60	6124/08	+	+	-	-	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
55	NARAYANAN	45	M	40-50	2685/09	+	-	-	-	+	+	H	CDL	H	CDL	H	CDL	CHOLEDOCHOLITHIASIS
56	BOOPATHY	65	M	60-70	886/09	+	+	+	+	-	-	H	CC	NAD	NAD	NAD	NAD	CHOLANGIOCARCINOMA
57	DURAIRAJ	69	M	60-70	1355/10	+	+	-	-	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
58	RAJESWARI	42	F	40-50	5675/06	+	+	-	-	-	-	S	POS	S	POS	H	POS	POST OP STRICTURE
59	RATHNASAMY	57	M	50-60	1885/09	+	+	-	-	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
60	ARJUNAN	44	M	40-50	6258/03	+	-	-	-	+	+	NAD	NAD	NAD	CDL	H	CDL	CHOLEDOCHOLITHIASIS
61	JAYANTHI	65	F	60-70	5375/09	+	+	+	-	-	-	H	CC	NAD	NAD	H	CC	CHOLANGIOCARCINOMA
62	RADHA	78	F	70-80	1081/08	+	+	-	-	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
63	SRIDHAR	58	M	50-60	4467/09	+	+	+	+	-	-	NAD	NAD	S	AC	S	AC	AMPULLARY CARCINOMA
64	RADHA BHAI	57	F	50-60	1200/10	+	+	-	-	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
65	CHELLAMMAL	45	F	40-50	199/09	+	-	-	-	+	+	NAD	NAD	H	CDL	H	CDL	CHOLEDOCHOLITHIASIS
66	BAMA	66	F	60-70	3076/08	+	+	-	-	-	-	H	CC	NAD	NAD	H	CC	CHOLANGIOCARCINOMA
67	MAHALAKSHMI	73	F	70-80	4761/09	+	+	-	+	-	-	H	CAGB	H	CAGB	H	CAGB	GB CANCER
68	DURAI	55	M	50-60	6224/09	+	+	+	+	-	-	NAD	NAD	NAD	NAD	S	AC	AMPULLARY CARCINOMA
69	SHENBAGAM	22	F	20-30	2075/08	+	-	-	+	+	+	S	CDC	S	CDC	S	CDC	CHOLEDOCHAL CYST
70	LOGAMBAL	46	F	40-50	6608/09	+	-	-	-	-	+	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS

						CLINICAL PRESENTATION						USG ABDOMEN		CT SCAN ABDOMEN		ERC		
71	RAGHU	72	M	70-80	3196/01	+	+	-	-	-	-	NAD	NAD	NAD	NAD	H	CC	CHOLANGIOCARCINOMA
72	ANDALAMMAL	75	F	70-80	501/08	+	-	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
73	SHEHJAHAN	58	M	50-60	2681/09	+	+	+	+	-	-	NAD	NAD	NAD	NAD	S	AC	AMPULLARY CARCINOMA
74	SHANKAR	34	M	30-40	1061/09	+	-	-	-	+	-	S	CDC	S	CDC	S	CDC	CHOLEDOCHAL CYST
75	SARASWATHI	48	F	40-50	725/09	+	-	-	-	-	+	S	CDL	NAD	CDL	S	CDL	CHOLEDOCHOLITHIASIS
76	DHANISH LAL	73	M	70-80	3121/08	+	+	-	-	-	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
77	AZHAGU	58	F	50-60	4409/08	+	-	+	+	-	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
78	PERUMAL	59	M	50-60	2496/09	+	+	+	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
79	PONNUSAMY	40	M	30-40	390/10	+	+	-	-	-	-	S	CDC	S	CDC	S	CDC	CHOLEDOCHAL CYST
80	SEETHA	59	F	50-60	4170/09	+	+	+	+	-	-	H	CC	H	CC	H	CC	CHOLANGIOCARCINOMA
81	UMALKUDHA	55	F	50-60	80/10	+	+	+	+	-	-	H	CC	NAD	NAD	H	CC	CHOLANGIOCARCINOMA
82	ANJAMMAL	53	F	50-60	3318/08	+	+	-	-	-	-	S	CC	S	CC	S	CC	CHOLANGIOCARCINOMA
83	SUDARJAH	56	M	50-60	3625/08	+	+	-	+	-	-	I	AC	NAD	NAD	NAD	NAD	AMPULLARY CARCINOMA
84	AMARA	52	F	50-60	6642/09	+	+	-	-	-	-	I	AC	NAD	NAD	I	AC	AMPULLARY CARCINOMA
85	GANGA	58	F	50-60	710/08	+	+	-	-	-	-	I	AC	NAD	NAD	I	AC	AMPULLARY CARCINOMA
86	UDYAKUMAR	42	M	40-50	58/10	+	+	-	-	-	-	H	CDC	NAD	NAD	H	CDC	CHOLEDOCHAL CYST
87	PARVATHY	42	F	40-50	1718/10	+	+	+	+	-	-	I	AC	I	AC	I	AC	AMPULLARY CARCINOMA
88	RAMAMURTHY	55	M	50-60	967/09	+	+	-	-	-	-	S	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS
89	KAMALA	46	F	40-50	3744	+	-	-	-	-	+	NAD	NAD	NAD	NAD	S	CDL	CHOLEDOCHOLITHIASIS
90	KANDASAMY	45	M	40-49	3365/08	+	-	-	-	-	+	NAD	CDL	S	CDL	S	CDL	CHOLEDOCHOLITHIASIS

S	SUPRAPANCREATIC
I	INTRAPANCREATIC
H	HILAR
+	PRESENT
-	ABSENT
CC	CHOLANGIOCARCINOMA
CAPH	CA HEAD OF PANCREAS
POS	POST OP STRICTURE
AC	AMPULLARY CARCINOMA
CDC	CHOLEDOCHALCYST
CDL	CHOLEDOCHOLITHIASIS
CAGB	GALLBLADDER CANCER
NAD	NOTHING ABNORMAL DIAGNOSED